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Daniel F. Nesbitt

Docket No.: DU-002-01
Serial No.: 10/790,410

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Applicant: Akbar HUSSAINI, et al. : Confirmation No.: 1458
Serial No.: 10/790,410 : Group Art Unit.: 1714
Filing Date: March 1, 2004 : Examiner: K.A. Sanders
For: APPLICATOR HEAD FOR APPLYING
FLUID MATERIAL TO SUBSTRATE

DECLARATION UNDER 37 CFR 1.131

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

We, Akbar Syed Hussaini, Silveiro Rodrigues, and Michael Jess Antoinie, do hereby declare as follows:

1. We are the inventors of the subject matter described and claimed in the above-identified patent application.

2. Before April 24, 2003, the filing date of U.S. Patent 6,872,761 B2 to LeStarge, we conceived and reduced to practice in the United States the invention described and claimed in Claim 14 and Claim 23 in the above application, as evidenced by the following attached copies of H.B. Fuller Invention Record 02-002, Research Notebook SR129, page 1, and a consultant's report from Kolano and Saha Engineers, Inc.

Invention Record 02-002	3 pages
Research Notebook SR129, page 1	1 page
Kolano and Saha Engineers, Inc. report	8 pages

Best Available Copy

True copies of the above pages, with all dates and unrelated information expunged, are attached. All such dates are prior to April 24, 2003.

3. Before April 24, 2003, embodiments of the invention claimed in the above application were made and tested by us or and under our supervision, as described in the above documents.

4. Invention Record 02-002 (IR 02-002) is a document dated before April 24, 2003. IR 02-002 describes a waterborne sound damping coating for bake resistance (between 124°C and 191°C) that provides improved sound damping and rheological properties at a high surface thickness (up to 5 mm), and shows improved low frequency vibration damping. Examples of formulations of the composition, denoted EF3030, is shown on the third page.

5. Research Notebook SR129, page 1 (SR129-1) is a document dated before April 24, 2003. SR129-1 shows a formula card for a bakeable (pre-baked) waterbase damper composition, including the ingredient names, types and target levels, the amount of each ingredient used, and the mixing procedure for making the composition. Also shown are the physical tests conducted on the pre-baked composition, including the density and the viscosity of the pre-baked composition. Also shown are the curing conditions, referred to as "drawdown" conditions, for preparation of samples of the post-baked composition on a substrate.

Specifically, SR129-1 shows a formula for the product entitled "EF3030. The pre-baked composition comprises 22% by weight n-butyl acrylate-acrylonitrile-styrene copolymer (40% by weight Acronal S504, a 55% solution in water), 2.5% by weight low-density glass bead filler (2.5% by weight Scotchlite® Bubble VS 5500 (glass)), 43.85% by weight additional fillers (31.52% by weight GPR 200 limestone and 12.31% by weight dry ground mica 4K), and 2.005% by weight rheology modifier (0.08% by weight Acrysol RM-8W, 1.425% by weight Acusol 820, and 0.50% by weight Attagel 30). SR129-1 also states that the pre-baked composition had a viscosity of 76,500 centipoises (cps), and a density of 10.5 lbs per gallon, about 1.25 g/cc, each property within the target range.

The drawdown times and temperatures for the compositions were conducted at four sets of conditions shown in SR129-1.

6. Kolano and Saha Engineers, Inc. report (K&S Report) is a document dated before April 24, 2003. K&S Report shows a vibration damping testing report prepared by the consultant after performing various sound damping tests on a sample of the post-baked sound damping composition applied to a substrate. K&S Report shows the sound-damping response of the post-baked compositions in the sub-Exhibits 1T-4T to the report.

Specifically, K&S Report shows that the pre-baked sound damping composition of the EF3030 product was applied to the test bars at a thickness ranging from 0.9 mm to 5.9 mm, and cured for 25 minutes at 165°C. The sample bars were then tested at five test temperatures each for sound damping performance.

7. The following statements explain how the compositions and methods described in above documents relate to the subject matter of Claim 14 and 23 in the above application.

Claim 14:

IR 02-002 and SR129-1 show an invention of a composition that was conceived and reduced to practice before April 24, 2003, comprising n-butyl acrylate-acrylonitrile-styrene copolymer (40% by weight Acronal S504, a 55% solution in water), low-density glass bead filler (2.5% by weight Scotchlite® Bubble VS 5500 (glass)), additional fillers (31.52% by weight GPR 200 limestone and 12.31% by weight dry ground mica 4K), and rheology modifier (0.08% by weight Acrysol RM-8W, 1.425% by weight Acusol 820, and 0.50% by weight Attagel 30). The pre-baked composition had a composition viscosity of 76,500 cps and a density of about 1.25 g/cc. The composition viscosity is within the target range of 60,000 – 1000,000 cps, established by the inventors to control sag and slide of the composition on a substrate.

K&S Report shows that the composition made according to SR129-1 provides a sound-damping response.

Claim 23:

IR 02-002 and SR129-1 show an invention of a composition that was conceived and reduced to practice before April 24, 2003, comprising a polymeric system (n-butyl acrylate-acrylonitrile-styrene), low-density glass bead filler (Scotchlite® Bubble VS 5500 (glass)),

additional fillers (GPR 200 limestone and dry ground mica 4K), and at least one rheology modifier (Acrysol RM-8W, Acusol 820, and Attagel 30). The pre-baked composition had a density of about 1.25 g/cc.

K&S Report shows that the compositions made according to SR129-1 provide a sound-damping response, and that the baked compositions have a lower density, in the range of about 0.46 to 0.80, that that of the pre-baked composition.

8. All acts described herein were conducted in the United States before April 24, 2003 with respect to Invention Record 02-002, Research Notebook SR129, page 1, and the Kolano and Saha Engineers, Inc. report.

We further declare that all statements made of our knowledge are true and that all statements made on information and belief are believed to be true; further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 USC 1001 and may jeopardize the validity of the application or any patent issuing thereon.

Date

Akbar Syed Hussaini

Date

Silveiro Rodrigues

Date

Michael Jess Antoinie

18 USC 1001: *"Whoever in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both."*

additional fillers (GPR 200 limestone and dry ground mica 4K), and at least one rheology modifier (Acrysol RM-8W, Acusol 820, and Attagel 30). The pre-baked composition had a density of about 1.25 g/cc.

K&S Report shows that the compositions made according to SR129-1 provide a sound-damping response, and that the baked compositions have a lower density, in the range of about 0.46 to 0.80, that that of the pre-baked composition.


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1/26/06
Date

1/26/06
Date

1/26/06
Date


Akbar Syed Hussaini


Silveiro Rodrigues


Michael Jess Antoine

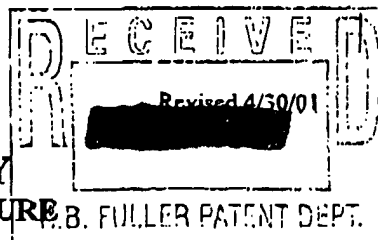
18 USC 1001: "Whoever in any matter within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious or fraudulent statements or representations, or makes or uses any false writing or document knowing the same to contain any false, fictitious or fraudulent statement or entry, shall be fined not more than \$10,000 or imprisoned not more than five years, or both."

HB# 02-002

FORM A

(Patent Department fills this in)

α H.B. FULLER COMPANY
CONFIDENTIAL INVENTION DISCLOSURE



Inventors: Akbar Hussaini, Silveiro Rodrigues

Department Name/Department (Billing)# /Department Manager Name:

EFTEC Waterborne Group/ Billing #700700.135.0101.145/M. Pellay or T. Zhizak

Disclosure Title: Bakeable Light Weight Waterbase Sound Deadener

Technology Area: ☒ Waterbase ☐ Hot Melt ☐ Thermoset ☐ Reactive ☐ Other
(check one)

Include: (Type all the information, if possible, in the following pages and inventor(s) sign each page)

- 1) Describe the invention including ingredients of a composition (or a product) or steps of a process.
- 2) Describe the utility of the invention, the difference(s) and advantage(s) over previous approaches.
- 3) Provide examples that illustrate the invention.
- 4) Identify all people (inventors) who have contributed to this invention.
- 5) List and attach any other relevant information such as patent and literature searches, internal reports, drawings, etc. SAE Paper 2000-01-1391
- 6) Provide notebook pages showing the invention date. Lab book SR125-SR130
- 7) Is this invention potentially a trade secret?
- 8) Has the associated product been sampled and/or sold? Yes/No (circle one) If yes,
(a) Please indicate when _____
(b) Was a secrecy agreement signed? Yes/No (circle one) _____
(c) What is the associated product name(s) or number(s)? EF 3030
- 9) List the LPS project number related to this invention.
- 10) List any other HBF patent disclosure, patent application or granted patent that is related to this disclosure.

Check the ONE MOST PERTINENT business area:

Industrial Products

- ☒ Non-woven
- ☐ Converting
- ☐ Tape & Label
- ☐ Graphic Arts

Performance Products

- ☐ Footwear
- ☐ Assembly
- ☐ Packaging

Specialty

- ☐ GCD
- ☐ Liquid Paints
- ☐ Foster
- ☐ TEC
- ☐ Consumer Products

Full-Value

- ☐ Linear
- ☐ AGS
- ☐ Window
- ☐ LCT
- ☐ NBD

Other

- ☒ EFTEC
- ☐ Fiber-Resin

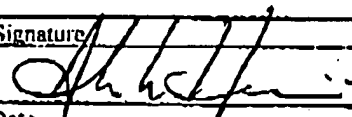
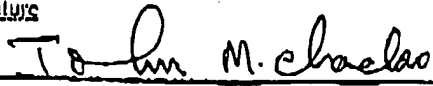


Send Original Form A to: Patent Department, WLB-2

INVENTION DISCLOSURE DESCRIPTION

This invention and its derivatives are acrylic based high solids (73-83%) waterborne sound damper coatings/sealers for bake resistance (124°C to 191°C) primarily used in the automotive, industrial and appliance industries. This product's density (1.5 ± 0.2 g/cc) allows for excellent sound damping and rheological properties at high surface thicknesses (up to 5mm). The composition has excellent adhesion to a variety of substrates (electrocoat, engineered plastics, and stainless steels). The primary objective of this invention is best described as a feasible and automated method to replace manually applied (labor intensive) die-cut or mastic sound deadening pads. The material has shown improved low frequency vibration damping (0-1000 Hz) over previously developed sound damping coatings and/or die cut sound pads at same surface weights. This invention allows the NVH (Noise Vibration and Harshness) Engineer at a customer to coat his/her part with less material weight and less coverage than previous treatments without compromising sound qualities. This invention has also found use in the automotive exterior wheelhouse and underbody applications as an anti-chip, sealer and blackout coating. Also, for automotive interiors, the increased elasticity over its predecessors has allowed this product to be used as an interior seam sealer. For industrial and appliance applications (sinks, dishwashers etc), this invention also allows the OEM Engineer to reduce "airborne noise" (sound transmittance) with less material usage and coverage than previous or historical treatments (pads and thin film coatings).

This product (EF3030) consists of 25-45 % n-butyl acrylate-acrylonitrile-styrene copolymer. Derivatives of this invention have portions (10% or less) based around glycidyl methacrylate functional multipolymer acrylic and/or dispersion of acrylic ester copolymer and/or asphaltic emulsion with specific glass transition temperatures. Variations may be employed to shift peak damping response temperature above or below the current 25°C as required. Fillers (45-65%) include dolomitic limestone, limestone, calcium carbonate, plastic micropsheres, glass bubbles and mica. The composition also includes (<5%) rheological modifiers and other additives (<5%) for sag/slide resistance and shelf stability respectively.

At specified surface weights, typical bakeable, air dry waterborne coatings or other low frequency vibration damping coatings (epoxy or PVC based) do not fully exceed die-cut sound pads for the entire temperature range between -20° to 60°C. With this waterborne coating EF3030, the damping response out performs sound pads and other coatings at all temperatures between -20 and 60°C using SAEJ1637 Oberst Bar method at 2.44 kg/m².

Described by: (Inventor(s))	Read & Understood by: (Witness)
<u>AKBAR HUSSAIN</u>	<u>JOHN CHACKO</u>
Print or type name	Print or type name
Signature	Signature
	
Date	Date
	

Send Original Form A to: Patent Department, WLB-2

Date:

Product:

EF3030 Formulations

IBM#	Raw Material Description	A %	B %	C %
21-0107	Water	3.0500	3.0500	3.0500
14-0052	PROPYLENE GLYCOL	4.0000	4.0000	4.0000
02-1051	Hydropalate 100	0.9000	0.9000	0.9000
02-0528	Pluronic F87 Prill surfactant (30% Sol. In water)	0.9000	0.9000	0.9000
19-0859	Attagel 30	2.5000	2.5000	2.5000
26-1727	Acronal S504	40.0000	35.0000	35.0000
26-2124	Acronal A 378	0.0000	5.0000	0.0000
PN-3610K	GMA	0.0000	0.0000	5.0000
07-0220	KATHON LX	0.0200	0.0200	0.0200
18-0200	Auraspense W-7017	0.2000	0.2000	0.2000
19-1476	GPR 200 Limestone	31.8300	31.8300	31.8300
21-0107	Water	0.2400	0.2400	0.2400
28-1236	Acrysol RM-8W	0.0800	0.0800	0.0800
19-1066	Dry Ground Mica 4K	12.3100	12.3100	12.3100
19-1414	Expancel DU 092-120	0.0200	0.0200	0.0200
19-1456	Duolite M6050AE	0.2500	0.2500	0.2500
19-1155	Scotclite Bubbles VS 5500 (Glass)	2.5000	2.5000	2.5000
02-0102	AMP-95	0.0500	0.0500	0.0500
26-0599	Acusol 820 rheology modifier	0.8000	0.8000	0.8000
03-0241	Rhodoline 646	0.3500	0.3500	0.3500
	TOTAL	100.0000	100.0000	100.0000

Lab# SR129-1
 Product Bakeable waterbase damper
 Customer [REDACTED]
 Spec# TBD
 Aim Finalize the formula for Tox submission
 SR128M type, to improve foam effect and sound
 dampening
 Ref SR/PMG
 Tech [REDACTED]
 Date [REDACTED]
 EF3030: For application study by [REDACTED]

work R&D
 size 5.0 gal (just right size)
 scale# [REDACTED]
 oven# 6 & 26
 oven# 3
 oven# 10
 Project# WN99059
 Product# EF3030

50 44/lb
 54 20/gal

Mixer		Air mixer using Cowles blade		Mix Procedure:	
Order	IBM#	Raw Material Description	%	Amount, G	
1	21-0107	Water	3.0500	732.0	Add 1 to 4 and enough of Acronal S 504 stir in Plastic container to a paste before adding anything else
2	18-0200	Aurasperse W-7017	0.1000	24.0	
3	19-0859	Attapel 30	0.5000	120.0	
4	19-0024	ASP 400	4.0000	960.0	Add remaining 4 to 9 and stir in Plastic container
5	26-1727	Acronal S504	40.0000	9600.0	
7	03-0241	Rhodoline 646	0.2500	60.0	Add 10, 11, 12, as mixing, + extra mixing Mix thoroughly to a smooth paste.
8	02-0528	Pluronic F87 Prill surfactant (30% Sol. in water)	0.4500	108.0	
9	14-0052	PROPYLENE GLYCOL	1.5000	360.0	Add 10 as mixing for 3 min
10	07-0220	KATHON LX	0.0200	4.8	
11	19-1476	GPR 200 Limestone	31.5200	7564.8	Add 12 as mixing & mix for 3 min more
12	19-1066	Dry Ground Mica 4K	12.3100	2954.4	
13	19-1414	Expancel DU 092-120	0.0200	4.8	Add 13 as mixing & mix for 3 min more
14	14-0052	PROPYLENE GLYCOL	2.5000	600.0	
15	19-1456	Duolite 6050AE	0.2500	60.0	Add 14 & 15 as mixing and Thixotropy should develop. Run viscosity. If meets the requirement
16	19-1155	Scotclite Bubbles VS 5500 (Glass)	2.5000	600.0	
17	02-0102	AMP-95	0.0500	12.0	Add 16, 17 & 18 as mixing and finish batch (2min mixing)
18	28-1236	Acrysol RM-8W	0.0800	19.2	
19	26-0599	Acusol 820* rheology modifier	1.4250	342.0	Run viscosity. If meets the requirement
20	03-0241	Rhodoline 646	0.1000	24.0	
TOTAL			100.6250	24150.0	

* Predisperse Acrysol TT-615 Rheology modifier in water at 1:1

Water = 40.00%
 Solids = 51.10%
 Additives = 8.84%

	TEST	initial	1day						
initial SPEC	TEST								
60k - 100k cps	20 rpm, cpoise, #7 sp, 77°F; 1' reading	76.500	89.000						
35-55 sec	CS; 0.125/10 psi; 50 g @ 77°F	42.0	75.2						
	Regular tip application								
	swirl application								
70% min.	Theoretical % solids	71.00%							
70% min.	Actual % solids, 2g for 1hr @ 220°F	71.50%							
1.2 - 1.44	Sp. Gravity (1.20 - 1.44)	1.26							
11.0 ± 1.0 lb	WuGal; lb (9.5 - 12.5)	10.50							
	DRAW DOWN 100x25x1.5 mm wet on ED panel test for 10-15'								
	10' @ 250°F + 30' @ 300°F + 30' @ 266°F								
	DRAW DOWN 100x25x1.5 mm wet on ED panel test for 10-15'								
	30' @ 300°F + 30' @ 266°F								
	DRAW DOWN 100x25x1.5 mm wet on ED panel test for 10-15'								
	10' @ 285°F + 30' @ 290°F + 30' @ 266°F								
	DRAW DOWN 100x25x1.5 mm wet on ED panel test for 10-15'								
	10' @ 250°F + 30' @ 325°F + 30' @ 266°F								
cf	Adhesion** (0 no adhesion-10 exc)								
	Heat age; 3d 110F								
	20 rpm								
	CS; 0.125/10 psi; 50 g @ 77°F								
	Young's Modulus								
	Sag point (3 mm min)								
5 pli	180° peel adhesion**, pli								
2"/min pull	Tensile**, psi, Wait 2 HR after bake								
15% min	Elongation**, %								

** 5 - 10 min wait at RT + 10' @ 250°F + 30' @ 300°F + 30' @ 266°F
 (0 no crack - 10 severe cracking)

§ non vac

cracking scale



Mr. Akbar Hussaini
EFTEC North America, LLC
31601 Research Park Drive
Madison Heights, MI 48071

**Subject: Results of Oberst Bar Vibration Damping Tests of Spray-on
Damping Materials**

EFTEC North America, LLC Purchase Order No. 34778
Kolano and Saha Engineers, Inc. Project No. 2001-189

Dear Mr. Hussaini:

This letter reports the results of Oberst bar damping tests of one waterbased/spray-on damping material (EF 3030) that you provided us. The study involved determining the damping performance of this material at different thickness. The results are expressed in terms of composite loss factor obtained using the Oberst Bar test method. Later, further computation was conducted to obtain composite and material Young's Modulus, and material loss factor. Test procedures followed for these measurements were in accordance with the test method described per the SAE Recommended Practice J1637-93, *Laboratory Measurement of the Composite Vibration Damping Properties of Materials on a Supporting Steel Bar*.

It should be noted that a similar, but more detailed study was done earlier this year (Kolano and Saha Engineers, Inc.) Project No. 2001-039 dated [REDACTED] on material EF 3000. The material EF 3030 that is discussed in this report has the same surface weight and cure condition as that of the EF 3000 in four specific cases.

Test Sample

The samples that were tested are as follows:

Sample		Measured Data		
		Thickness	Surf. Wt.	Test Temp.
No.	<u>Sample Description</u>	<u>(mm)</u>	<u>(kg/m²)</u>	<u>(°C)</u>
1	EF 3030	0.9	0.7	60,40,25,10,-10
2	EF 3030	2.7	1.3	60,40,25,10,-10
3	EF 3030	4.4	2.6	60,40,25,10,-10
4	EF 3030	5.9	4.0	60,40,25,10,-10

The cure condition for all the samples were High/Nominal 25 min @ 165° C. This is the same cure condition as that of Samples 7, 3, 15, and 23 (Exhibits 7T, 3T, 15T, and 23T).

All samples were prepared by EFTEC. The dimensions of these bars were: total length 225 mm, free length 200 mm, thickness 0.8 mm, and width 12.7 mm (Figure 1).

In this study no bare steel bars were tested. However, the average resonant frequency data of the bare bar resonance needed to compute material properties was obtained from an earlier project done for EFTEC (Kolano and Saha Engineers, Inc. Project No. 2001-039 dated [REDACTED]). Results obtained from measurements made on bare bars and damped bars were used to compute material loss factor and material Young's modulus. ASTM Standard E756 provides the equations that were used for computing material properties and are listed in Attachment A. It should be noted that the ASTM Standard also mentions the precautions that one should take into account and the limitations that one should be aware of regarding the valid use of these equations.

Measurements

Tests were made on a fixture to measure modes of vibration of the test sample using a random noise signal. The resonant frequency and the half power bandwidth (frequency difference between 3 dB downpoints from the resonant peak) of each mode needed for composite loss factor (η_c) computation, were read directly from a dual channel signal analyzer (B&K Type 2032). Any deviation from this procedure if applicable is mentioned in the data sheets. A complete description, and calibration records of the instrumentation used are on file with K&SE.

It also should be noted that not always the 3 dB down points on both sides of the resonant frequency were measurable. In such cases the "n" dB down point method was used wherever possible per SAE Standard J1637-93.

Results

Results of these tests are presented in tabular form in Exhibits 1T through 4T. These exhibits provide the composite loss factor and composite Young's modulus plus the material loss factor and material Young's modulus data at each mode of vibration at a given temperature wherever it could be computed. The numbers 1 through 4 are also the identifications of the test bars.

The tables also show the interpolated values at 200 Hz, 400 Hz, and 800 Hz for each temperature. These values are based on linear interpolation of two sets of data points where the frequency and the loss factor (or the modulus) information are provided in a logarithmic scale. According to this technique, the damping performance at 200 Hz (as an example) is interpolated by intersecting the 200 Hz frequency line (i.e. the vertical line) and the straight line connecting the damping (or modulus) performance values for the resonant frequencies directly on either side of 200 Hz. Likewise, interpolation at 400 or 800 Hz is computed by intersecting the 400 or 800 Hz frequency line and the straight line connecting the loss factor (or modulus) values for the resonance, directly on either of 400 or 800 Hz, respectively. It should be noted that due to the limitation of the equation (used in computing material properties) as mentioned earlier and that all modes could not always be measured, not all data could be computed. In such cases the interpolated data of composite loss factor, composite Young's modulus, material loss factor, and material Young's modulus are left blank.

Exhibits 1GA through 4GA show the composite loss factors of the material at the five test temperatures that is described in report 2001-039 in graphical form. Exhibits 1GB through 4GB show the composite loss (η_c), and the composite Youngs Modulus (E_c), at 200, 400, and 800 Hz. For ease of comparing the results of EF 3030 that could be compared with that of EF 3000 (Project 2001-039) are provided as Exhibits 7T-1T, Exhibits 3T-2T, Exhibits 15T-3T, and Exhibits 23T-4T respectively.

Mr. Hussaini, we appreciate this opportunity to be of service to EFTEC. Please telephone me should you have any questions or comments regarding the data. We are looking forward to working together again in the future.

Sincerely,

KOLANO AND SAHA ENGINEERS, INC.

Wayne P. Miller

Wayne P. Miller
Technician

Approved by:

Pranab Saha

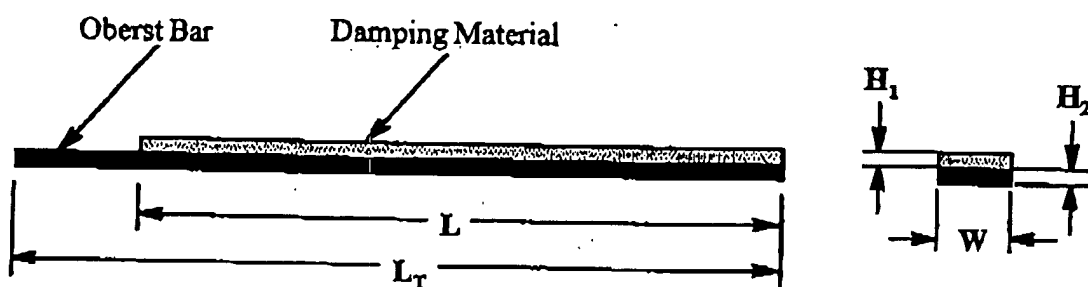
Pranab Saha, Ph.D., P.E.
Principal Consultant

WPM:lps

Figure 1

TEST SAMPLE FOR OBERST BAR DAMPING TESTS

Bar Without Roots



LEGEND

L = Free Length of the Oberst Bar: 200 mm (7.87 in.)
This is also the Length of the Damping Material

L_T = Total Length of the Oberst Bar: 225 mm (8.86 in.)

W = Width of the Oberst Bar: 12.7 mm (0.5 in.)

H_2 = Thickness of the Oberst Bar in the Vibration Direction: 0.8 mm (0.031 in.)

H_1 = Thickness of the Damping Material

VIBRATION DAMPING PROPERTIES

Material Supplier: EFTEC North America, LLC

Sample Description: EF3030 (1)

Cure Condition: N/A

Material Type: Sprayon waterbase/extensional layer

Classification: 8

Sample Information	Surface Wt:	Manf. Data	Measured Data	Steel Bar	Units	
		Density:			kg/m ²	kg/m ³
	Thickness:	N/A	0.9	0.8	mm	

TEST TEMPERATURE	MODE	Measured Data		Computed Data		
		RESONANT FREQUENCY f_c (Hz)	COMPOSITE LOSS FACTOR η_c	COMP. YOUNG'S MODULUS E_c (Pa)	MATERIAL LOSS FACTOR η_1	MAT. YOUNG'S MODULUS E_1 (Pa)
-10°C (14°F)	2	117	0.009	5.97E+10	0.030	5.74E+09
	3	330	0.008	6.02E+10	0.027	5.79E+09
	4	645	0.007	6.00E+10	0.024	5.67E+09
	5	1055	0.007	5.87E+10	0.025	5.19E+09
	6	1562	0.007	5.77E+10	0.027	4.85E+09
	Interpolated	200	0.008	6.00E+10	0.028	5.77E+09
		400	0.008	6.02E+10	0.026	5.76E+09
		800	0.007	5.95E+10	0.025	5.45E+09
10°C (50°F)	2	111	0.033	5.32E+10	0.150	3.71E+09
	3	314	0.031	5.46E+10	0.133	4.04E+09
	4	617	0.026	5.49E+10	0.111	4.08E+09
	5	1014	0.023	5.43E+10	0.103	3.84E+09
	6	1507*4	0.024	5.38E+10	0.112	3.64E+09
	Interpolated	200	0.032	5.40E+10	0.140	3.89E+09
		400	0.029	5.47E+10	0.125	4.05E+09
		800	0.024	5.46E+10	0.107	3.95E+09
25°C (77°F)	2	103	0.042	4.61E+10	0.393	1.53E+09
	3	294*2	0.045	4.78E+10	0.343	1.95E+09
	4	581	0.047	4.87E+10	0.328	2.17E+09
	5	963	0.044	4.89E+10	0.306	2.19E+09
	6	1437	0.042	4.89E+10	0.297	2.16E+09
	Interpolated	200	0.044	4.72E+10	0.360	1.78E+09
		400	0.046	4.82E+10	0.336	2.05E+09
		800	0.045	4.88E+10	0.314	2.18E+09
40°C (104°F)	2	100	0.013	4.33E+10		
	3	282*3	0.018	4.41E+10		
	4	555	0.026	4.44E+10		
	5	917	0.031	4.44E+10		
	6	1371	0.047	4.45E+10		
	Interpolated	200	0.016	4.39E+10		
		400	0.022	4.43E+10		
		800	0.030	4.44E+10		
60°C (140°F)	2	99	0.006	4.28E+10		
	3	278	0.007	4.29E+10		
	4	545	0.016	4.28E+10		
	5	901	0.045	4.28E+10		
	6	1378	0.061	4.50E+10		
	Interpolated	200	0.007	4.28E+10		
		400	0.011	4.28E+10		
		800	0.035	4.28E+10		

*2- 2dB downpoint method

*3- 3dB downpoint one side method

*4- Calculated from printout

Measurements Conducted per SAE J1637

Bar Free Length: 200 mm

VIBRATION DAMPING PROPERTIES

Material Supplier: EFTEC North America, LLC

Sample Description: EF3030 (2)

Cure Condition: N/A

Material Type: Sprayon waterbase/extensional layer

Classification: 11

		Manf. Data	Measured Data	Steel Bar	Units	
Sample Information	Surface Wt:	1.3	1.3	6.3	kg/m ²	
	Density:	N/A	458	7936	kg/m ³	
	Thickness:	N/A	2.7	0.8	mm	
TEST TEMPERATURE	Measured Data			Computed Data		
	MODE	RESONANT FREQUENCY f _c (Hz)	COMPOSITE LOSS FACTOR η _c	COMP. YOUNG'S MODULUS E _c (Pa)	MATERIAL LOSS FACTOR η ₁	MAT. YOUNG'S MODULUS E ₁ (Pa)
-10°C (14°F)	2	152	0.017	7.96E+09	0.028	1.39E+09
	3	420	0.015	7.75E+09	0.025	1.32E+09
	4	826	0.014	7.82E+09	0.024	1.34E+09
	5	1371	0.014	7.88E+09	0.024	1.35E+09
	Interpolated	200	0.016	7.90E+09	0.027	1.37E+09
		400	0.015	7.76E+09	0.025	1.33E+09
		800	0.014	7.82E+09	0.024	1.34E+09
10°C (50°F)	2	136	0.072	6.34E+09	0.140	9.30E+08
	3	383	0.058	6.44E+09	0.112	9.50E+08
	4	758	0.052	6.58E+09	0.099	9.86E+08
	5	1267	0.049	6.73E+09	0.092	1.02E+09
	Interpolated	200	0.066	6.38E+09	0.129	9.38E+08
		400	0.058	6.45E+09	0.111	9.53E+08
		800	0.052	6.60E+09	0.098	9.80E+08
25°C (77°F)	2	110	0.127	4.15E+09	0.471	3.14E+08
	3	320	0.130	4.51E+09	0.404	4.07E+08
	4	642	0.135	4.73E+09	0.387	4.64E+08
	5	1100	0.131	5.07E+09	0.336	5.57E+08
	Interpolated	200	0.129	4.35E+09	0.433	3.63E+08
		400	0.132	4.58E+09	0.399	4.25E+08
		800	0.133	4.86E+09	0.365	5.00E+08
40°C (104°F)	2	100	0.037	3.47E+09		
	3	285	0.056	3.58E+09		
	4	566	0.067	3.67E+09		
	5	952	0.087	3.80E+09		
	6	1420	0.108	3.79E+09		
	Interpolated	200	0.049	3.54E+09		
		400	0.061	3.62E+09		
800		0.080	3.75E+09			
60°C (140°F)	2	98	0.011	3.31E+09		
	3	277	0.017	3.37E+09		
	4	545	0.022	3.40E+09		
	5	905	0.025	3.44E+09		
	6	1355	0.029	3.45E+09		
	Interpolated	200	0.015	3.35E+09		
		400	0.020	3.39E+09		
800		0.024	3.43E+09			

VIBRATION DAMPING PROPERTIES

Material Supplier: EFTEC North America, LLC
 Sample Description: EF3030 (3) Cure Condition: N/A
 Material Type: Sprayon waterbase/extensional layer Classification: 89

Sample Information	Surface Wt: Density: Thickness:	Manf. Data	Measured Data	Steel Bar	Units	
		2.5 N/A N/A	2.8 594 4.4	6.3 7936 0.8	kg/m ² kg/m ³ mm	

TEST TEMPERATURE	Measured Data			Computed Data		
	MODE	RESONANT FREQUENCY f_c (Hz)	COMPOSITE LOSS FACTOR η_c	COMP. YOUNG'S MODULUS E_c (Pa)	MATERIAL LOSS FACTOR η_1	MAT. YOUNG'S MODULUS E_1 (Pa)
-10°C (14°F)	2	200	0.022	4.58E+09	0.028	1.02E+09
	3	592	0.021	5.12E+09	0.026	1.17E+09
	4	1199	0.021	5.48E+09	0.026	1.27E+09
	Interpolated	200	0.022	4.58E+09	0.028	1.02E+09
		400	0.021	4.92E+09	0.027	1.12E+09
		800	0.021	5.28E+09	0.026	1.22E+09
10°C (50°F)	2	172	0.103	3.41E+09	0.140	6.98E+08
	3	519	0.091	3.94E+09	0.119	8.43E+08
	4	1056	0.086	4.25E+09	0.110	9.28E+08
	Interpolated	200	0.101	3.48E+09	0.137	7.16E+08
		400	0.094	3.81E+09	0.123	8.06E+08
		800	0.088	4.13E+09	0.113	8.94E+08
25°C (77°F)	2	119	0.254	1.62E+09	0.538	2.08E+08
	3	377	0.303	2.08E+09	0.520	3.30E+08
	4	759*1	0.349	2.19E+09	0.580	3.81E+08
	5	1402*1	0.311	2.74E+09	0.460	5.10E+08
	Interpolated	200	0.275	1.81E+09	0.530	2.56E+08
		400	0.307	2.09E+09	0.525	3.33E+08
		800	0.346	2.24E+09	0.568	3.72E+08
40°C (104°F)	2	98	0.097	1.10E+09		
	3	289.4	0.155	1.23E+09		
	4	570	0.240	1.24E+09		
	5	1031*1.5	0.301	1.40E+09		
	6			0.00E+00		
	Interpolated	200	0.132	1.18E+09		
		400	0.191	1.23E+09		
		800	0.273	1.37E+09		
60°C (140°F)	2	91	0.039	9.46E+08		
	3	261	0.050	9.97E+08		
	4	518	0.064	1.02E+09		
	5	866	0.075	1.05E+09		
	6	1287	0.102	1.04E+09		
	Interpolated	200	0.047	9.84E+08		
		400	0.058	1.01E+09		
		800	0.073	1.04E+09		

*) - Based on 1 dB downpoint method

*) 1.5 - Based on 1.5 dB downpoint method

Measurements Conducted per SAE J1637

Bar Free Length: 200 mm

VIBRATION DAMPING PROPERTIES

Material Supplier: EFTEC North America, LLC

Sample Description: EF3030 (4)

Cure Condition: N/A

Material Type: Sprayon waterbase/extensional layer

Classification: 36

Sample Information	Surface Wt:	Manf. Data	Measured Data	Steel Bar	Units	
		4.4	4.0	6.3	kg/m ²	
	Density:	N/A	670	7936	kg/m ³	
	Thickness:	N/A	5.9	0.8	mm	

TEST TEMPERATURE	MODE	Measured Data		Computed Data		
		RESONANT FREQUENCY f_c (Hz)	COMPOSITE LOSS FACTOR η_c	COMP. YOUNG'S MODULUS E_c (Pa)	MATERIAL LOSS FACTOR η_1	MAT. YOUNG'S MODULUS E_1 (Pa)
-10°C (14°F)	2	281	0.030	4.75E+09	0.034	1.19E+09
	3	872	0.033	5.85E+09	0.037	1.51E+09
	Interpolated	200	0.029	4.47E+09	0.033	1.11E+09
		400	0.031	5.07E+09	0.035	1.28E+09
		800	0.033	5.76E+09	0.037	1.48E+09
10°C (50°F)	2	226	0.163	3.08E+09	0.191	7.28E+08
	3	722	0.147	4.00E+09	0.168	9.82E+08
	4	1399	0.160	3.92E+09	0.183	9.57E+08
	Interpolated	200	0.165	3.00E+09	0.193	7.05E+08
		400	0.155	3.51E+09	0.179	8.43E+08
		800	0.149	3.99E+09	0.170	9.78E+08
25°C (77°F)	2	143	0.351	1.23E+09	0.518	2.23E+08
	3	474*1.5	0.458	1.72E+09	0.599	3.56E+08
	4	852*4	0.478	1.45E+09	0.662	2.82E+08
	Interpolated	200	0.378	1.35E+09	0.540	2.54E+08
		400	0.441	1.64E+09	0.587	3.33E+08
		800	0.476	1.48E+09	0.655	2.89E+08
40°C (104°F)	2	109	0.148	7.12E+08		
	3	324*2	0.224	8.08E+08		
	4	628*3	0.262	7.89E+08		
	5	1204*3	0.296	1.06E+09		
	6			0.00E+00		
	Interpolated	200	0.187	7.64E+08		
		400	0.235	8.02E+08		
		800	0.274	8.81E+08		
60°C (140°F)	2	97	0.071	5.70E+08		
	3	282*4	0.090	6.12E+08		
	4	561	0.109	6.31E+08		
	5	939	0.131	6.46E+08		
	6	1383*2	0.167	6.28E+08		
	Interpolated	200	0.083	5.98E+08		
		400	0.099	6.22E+08		
		800	0.124	6.41E+08		

*1- 1.5dB downpoint method

*2- 2dB downpoint method

*3- 3dB downpoint one side method

*4- calculated from printout

Measurements Conducted per SAE J1637

By Free Length: 200 mm

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